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BEHAVIORAL ASSESSMENT AND TREATMENT OF CHRONIC FOOD REFUSAL IN HANDICAPPED CHILDREN

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In this study, we examined the eating behavior of four handicapped children, none of whom exhibited self-feeding skills. All children had a history of food refusal and were nutritionally at risk; one child received all nourishment by way of a gastrostomy tube. Baseline data taken during mealtimes indicated that all children accepted very little food, expelled food frequently, and engaged in a number of disruptive behaviors. Treatments consisted of one or more of the following contingent events: social praise, access to preferred foods, brief periods of toy play, and forced feeding. Results of multiple-baseline and reversal designs showed marked behavioral improvement for each child and increases in the amount of food consumed. Further improvements were noted at follow-up, which ranged from 7 to 30 months posttreatment.

DESCRIPTORS: behavioral assessment, behavioral medicine, feeding

Children who consume insufficient amounts of food are at high risk for a number of problems, including excessive weight loss, lethargy, malnutrition, diminished function, and growth retardation (Howard & Cronk, 1983; Martin, 1973; Rosso & Winick, 1973; Wurtman & Wurtman, 1977). Such dietary inadequacies are especially common among handicapped children and may occur in as much as a third of that population (Palmer & Horn, 1978).

Typical methods for treating dietary insufficiency include hyperalimentation (e.g., supplementation, forced feeding), intravenous feeding, and the use of oral-gastric, naso-gastric, or gastrostomy tubes. In cases of immediate risk from dehydration or severe malnutrition, these procedures often serve an essential stabilizing function. On the other hand, artificial feeding methods are undesirable as long-term strategies, for they do not actively promote effective feeding behavior and are themselves associated with additional health risks (Oliveras, Segovia, & Revuelta, 1974; Raventos, Kralemann, & Gray, 1982).

The etiology of feeding disorders can be attributed to a number of physiological abnormalities, such as anatomical defect, neurological dysfunction, and metabolic imbalance (Brown, Davis, & Flemming, 1979; Illingworth & Lister, 1964; Schmidt, 1976). Abnormal feeding patterns do not arise solely as a consequence of organic impairment, however. Environmental factors may play a significant role in the development, maintenance, or exacerbation of feeding problems (Christophersen & Hall, 1978; Iwata, Riordan, Wohl, & Finney, 1982; Jones, 1982; Linscheid, 1978). For example, Palmer and Horn (1978) concluded that behavioral mismanagement was the primary factor associated with over 21% of all feeding problems in handicapped children referred to their nutrition clinic over a 4-year period.

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In spite of the high prevalence of food refusal among handicapped children and indications that there may be a behavioral component to the problem, very little controlled research has attempted to describe deficient eating in detail or to evaluate potentially effective treatments. Such research would be useful in several respects. First, it would provide methods for identifying subtle aspects of feeding behavior that may require clinical intervention. Second, the controlled evaluation of specific feeding practices and reinforcement contingencies would yield information regarding a range of treatments and problems for which they are effective. Finally, direct assessment and intervention research with children would suggest methods for studying parent-child interaction during mealtimes (e.g., Thompson, Palmer, & Linscheid, 1977), and eventually lead to the design and evaluation of parent training programs to remediate and prevent serious feeding disturbances whose origin is primarily or partially behavioral in nature.

Attempts to measure food refusal have been reported in several single-case studies using a variety of procedures. When the results of these studies are combined, the data indicate that a number of responses and their outcomes may be relevant to the assessment of food refusal: acceptance of food when it is presented (Ives, Harris, & Wolchick, 1978; Thompson & Palmer, 1974), the variety of foods eaten (Bernal, 1972), food expulsion (Thompson, Iwata, & Poynter, 1979; Thompson & Palmer, 1974), crying and other disruptive behaviors (Thompson & Palmer, 1974), the amount of food eaten (Duker, 1981; Palmer, Thompson, & Linscheid, 1975), and body weight (Hatcher, 1979). Data from these studies also suggest the possibility of modifying one or more of the above behaviors using procedures such as social praise, access to preferred foods, forced feeding, and overcorrection.

Riordan, Iwata, Wohl, and Finney (1980) recently examined the eating behavior of two handicapped children whose diets were selective but who otherwise exhibited adequate self-feeding skills. Multiple behavioral and outcome measures were taken throughout baseline and treatment, and the effects of contingent social praise and access to preferred foods on food intake were evaluated via multiple-baseline designs. We describe an attempt to modify chronic and almost total food refusal in four children, none of whom displayed independent eating. In addition to extending the methods and findings of Riordan et al., we provide follow-up data, both formal and informal, on the long-term outcome of treatment.

GENERAL METHOD

Children

Four children (Joan, Nancy, Jerry, Holly) who were inpatients at The John F. Kennedy Institute participated in the study. Evaluations conducted on admission indicated that each child exhibited a severe eating problem consisting of either low overall or highly selective food intake. The children were included in this study based on the following criteria: (a) reported to be at physical risk due to a feeding problem, (b) showed no structural or other organic difficulties precluding oral food intake, and (c) mealtime observations suggested a behavioral component to the child's intake problem. None of the children had self-feeding skills. More specific descriptions of each child are included in the individual case presentations.

Settings and Sessions

Meals were conducted in one of three settings: the inpatient dining room, an occupational therapy treatment room, or the child's bedroom. Data were typically collected 5 days per week during meals fed by an experimenter. At each meal, two to five food items selected from the standard hospital menu were presented. These foods represented items from six food groups: fruit, vegetable, meat, starch, liquid, or other (i.e., combined). The experimenter offered bites of food to the child every 30 or 45 s, in an arbitrarily determined, rotating manner (i.e., one bite of each food was presented in succession, then the sequence was repeated). Data were collected only during the first half of the meal to reduce variability as a function of the children becoming "full" near the end of the meal. The entire

meal, however, was fed using a consistent procedure (e.g., either baseline or treatment).

Dependent Measures

An experimenter scored the occurrence or nonoccurrence of the following responses for each bite:

1. *Acceptance*: The child's mouth opened so that the spoon or piece of food could be delivered within 3 s after the food item was held within 1 in. of the mouth.

2. *Expulsion*: Any amount of food (that had been in the mouth) was visible outside the mouth (Joan only) or outside the lip and chin area (Nancy, Jerry, Holly) prior to presentation of the next bite.

3. *Disruptive behavior*: (a) *crying*: The child sobbed or screamed for at least 5 s during an interval; and (b) *interruption*: The child raised a hand between his or her face and the bite being presented or turned his or her head more than 45° away from food being presented.

The percentage of bites during which each behavior occurred was computed, both across all foods presented at a meal and separately for each food group. The percentage of expulsion was obtained by dividing the number of intervals during which expulsion was scored by the number of bites accepted, because food expulsion could only occur after a bite had been accepted. Periodic measures of the amount of food consumed and expelled were also taken by weighing each food item and the child's bib before and after each meal. These data were collected to assess correspondence between the actual quantity of food consumed and increases in acceptance or decreases in expulsion. These weight measures were recorded for 29% of Joan's meals, 23% of Nancy's, 100% of Jerry's, and 57% of Holly's. Finally, each child's body weight was recorded periodically by nursing staff.

Interobserver Agreement

A second observer independently scored all mealtime dependent measures during 36%–57% of the meals for each child. Interobserver agreement for all interval data was computed by dividing the number of agreements on the occurrence of the behavior by the number of agreements plus disagreements, and multiplying by 100. The mean percentages of agreement ranged from 99.4% to 99.7% for acceptance, 80.8% to 94.4% for expulsion, and 85.8% to 99.8% for disruptive behavior. Reliability measures on the amounts of food consumed and expelled were obtained by having two observers independently record the weights for each food and the bib. Interobserver agreement was computed by dividing the smaller of the two weights by the larger and multiplying by 100. The mean percentages of agreement ranged from 99.2% to 99.9%. No reliability data were collected on the children's body weights.

General Procedures

The following general procedures were implemented with all children. The experimental designs, target foods, and target responses varied somewhat; these differences are described in the treatment for each child.

Baseline. During meals in this condition, an experimenter presented a bite of food at the beginning of each interval, noncontingent on the child's behavior. A bite was presented by holding the spoon within 1 in. of the child's mouth. If the child opened his/her mouth, the bite of food was deposited. If the child did not open his or her mouth within 3 s or interrupted the bite by putting a hand between the spoon and mouth or turning away from the spoon, the spoon was withdrawn until the next interval. No consequences were delivered for appropriate or inappropriate eating behaviors during baseline.

Treatment. Foods were selected for training on the basis of extremely low percentages of acceptance or high percentages of expulsion during baseline meals. In addition, the child's nutritionist indicated a need to increase consumption of these target foods. The basic treatment procedure involved the delivery of reinforcement contingent on consumption of a target food item. For Joan, Nancy, and Jerry, highly preferred food items were identified as potential reinforcers in the baseline condition. However, because Holly did not accept any food item consistently prior to treatment, sev-

eral favorite toys (e.g., drum, xylophone) were identified as reinforcing events. Food refusal (except for Holly) and disruptive mealtime behaviors were ignored throughout treatment and during subsequent conditions.

Maintenance. Procedures used during this condition were similar to those in effect during the treatment phase, except that the reinforcer was delivered on an intermittent basis. Maintenance procedures were implemented at varying points for three of the four children.

Follow-up. Prior to discharge, each child's parents were trained by an experimenter (using modeling, role playing, and supervised practice over 2–5 sessions) to implement all treatment or maintenance procedures, and they were provided with a written set of discharge recommendations. Follow-up data were later obtained for three of the four children.

Case 1: Joan

Joan was a 16-month-old, nonambulatory female with cerebral palsy. She was referred for treatment because of refusal to eat fruits, vegetables, or meats, excessive crying during meals, and occasional vomiting. Her preadmission diet consisted almost exclusively of milk. Nutritional evaluations indicated that her weight was appropriate, but that her diet was deficient in vitamins and minerals. To ensure adequate nutrition across all experimental conditions (e.g., during baseline), Joan had free access to preferred foods at the evening meal, 6-oz bottles of milk between meals, and daily vitamin supplements.

Procedures

At each meal, 40 bites of five foods were presented, one every 30 s. During baseline, Joan refused to accept bites from several food groups, expelled many food items, and exhibited high levels of disruptive behavior. Two food items that were accepted at high rates (dry cereal and graham crackers) were identified as potential reinforcers. Two specific food items were selected for training—a fruit (applesauce) and a vegetable (pureed carrots). Specific food items were selected from each of the targeted food groups to maximize the number of training trials with each food. In addition, the preferred foods were delivered contingent on acceptance only, because this response was a prerequisite to other aspects of appropriate eating. Food expulsion and disruptive behaviors were ignored during all experimental conditions.

Treatment was implemented in a multiple-baseline design (Baer, Wolf, & Risley, 1968) across the two targeted foods, beginning with fruit. When treatment was implemented for the second food (vegetables), a return to baseline was conducted for fruit. Bites of the target food item and the preferred food were presented simultaneously during the first few treatment meals for both targeted foods. Thereafter, a transition was made so that the preferred food was delivered 2–3 s after the target food was accepted and, in later sessions, only on an intermittent basis.

The maintenance procedure consisted of reinforcement (a bite of preferred food plus praise) for approximately 50% of accepted bites. At various meals in the maintenance condition, fruit items other than applesauce and vegetable items other than carrots were also presented to assess whether these items would be accepted at rates comparable to the two specific items that had been selected for treatment.

Follow-up data were collected in the clinic 2 and 6 weeks after Joan's discharge. Baseline procedures (i.e., no reinforcement) were in effect throughout these meals for all foods, except on two occasions when Joan's acceptance of a vegetable item was followed by a preferred food.

Results

Figure 1 shows the percentages of bites that Joan accepted of fruit, vegetable, meat, and starch items (data are not presented for liquid, which she accepted readily, or for other food groups that were rarely present on her food tray). The baseline data indicated that Joan accepted very few bites of fruit and vegetable, and that her acceptance of meat and starch was highly variable. When small bites of cereal or graham cracker were presented first concurrent with, and later contingent on, accepting

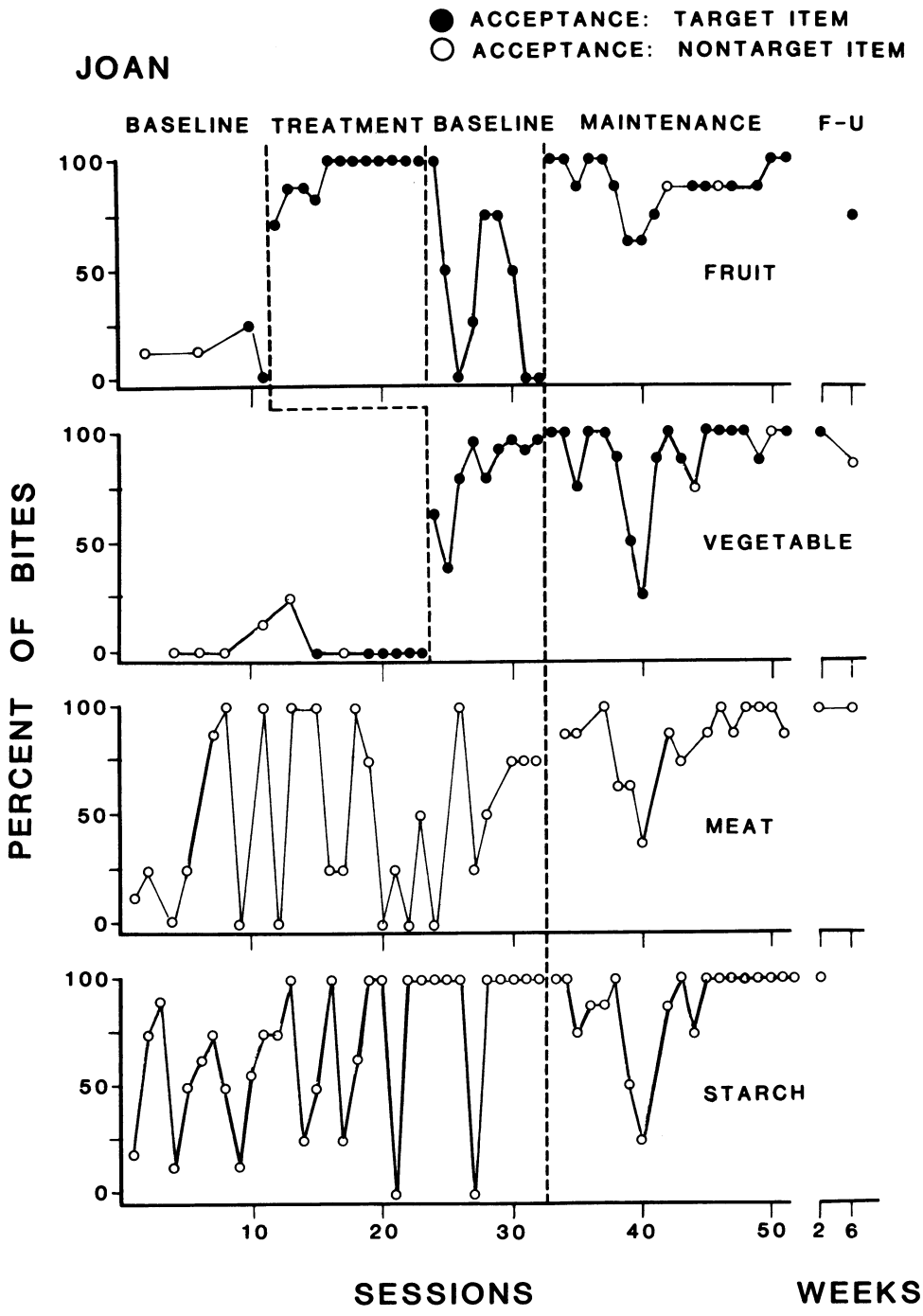

Figure 1. Percentages of bites that Joan accepted of fruit, vegetable, meat, and starch. ●—food items presented during initial treatment sessions; ○—items that were never exposed to the initial contingency.

Table 1
Mean Performance Across Conditions for Joan

Condition	Number of sessions	Mean percentage of bites			Mean number of grams consumed
		Acceptance	Expulsion	Disruption	
Baseline	11	53.4	70.4	43.1	76.1
Treatment of fruit	12	79.3	39.5	18.8	77.4
Treatment of vegetable	9	75.9	58.2	14.7	98.0
Maintenance	19	90.0	49.1	8.1	125.5
Follow-up	2	89.0	28.0	10.5	87.5

the target fruit and vegetable, Joan's acceptance of these items increased immediately. Her acceptance of fruit subsequently decreased when treatment was discontinued for that food item. Acceptance of fruit and vegetable, including both target and nontarget items, either increased further or remained high during the maintenance and follow-up conditions. Joan's acceptance of items from untrained food groups (meat and starch) appeared to be more consistent during maintenance than during baseline.

Table 1 shows Joan's condition means for acceptance, expulsion, disruptive behavior, and amount of food consumed. The data collected on grams of food consumed indicate a general correspondence between this measure and the directly observed behavior of food acceptance. Table 1 also shows that Joan's food expulsion and disruptive behavior (crying and interrupting) decreased noticeably during the course of treatment. A problem was noted, however, with Joan's expulsion. Informal observation and data collected on the amount of food expelled indicated that her expulsion decreased to almost zero during treatment. This change was not adequately reflected in the interval data, because even small amounts of food appearing only on the lips technically met the scoring criterion for expulsion. Because food remaining on the lips appeared to be a function of experimenter behavior (spoon placement) rather than child behavior, the definition was modified accordingly for subsequent children.

Joan's body weight remained stable across conditions. On discharge, she weighed 18.25 lb, the same as on the first day of baseline. The nutritionist's evaluation of Joan's diet at the end of the maintenance condition was that it was well balanced and that nutritional supplements were no longer necessary. Training sessions to promote the development of self-feeding skills were also initiated during the maintenance condition. Joan was able to finger feed, hold a cup, and scoop with a spoon at the time of discharge. A follow-up conducted by a pediatrician 14 months after discharge indicated that Joan possessed complete independence in feeding with a spoon, fork, and cup, and that there were no parental concerns regarding food refusal or selective eating.

Case 2: Nancy

Nancy was a 23-month-old, nonambulatory female with a chromosomal aberration and questionable visual acuity. Initial evaluations indicated that she had poor lip closure, oral hypersensitivity, and poor oral motor control with involuntary tongue movements; however, these problems were not of sufficient severity to prevent oral food intake. She was referred for treatment because of refusal to accept adequate amounts of many foods, failure to chew or swallow nonpreferred foods, and tantrums during meals. Throughout the study, she was given free access to preferred foods at the evening meal.

Procedures

Forty bites of five foods were presented at each meal, one bite every 30 s. Three specific food items were targeted for intervention—starch (bread), meat (scrambled eggs), and vegetable (green beans)—on the basis of high baseline rates of expulsion. Canned fruits and ice cream were identified as preferred foods.

Treatment was implemented in a multiple-baseline design across foods. Although Nancy's most serious feeding problem was a failure to swallow many foods (i.e., high rates of expulsion), contin-

gencies were placed only on acceptance. Food expulsion and disruptive behaviors were ignored. A bite of the target starch item and the preferred food were delivered simultaneously during the first 2–4 treatment meals; thereafter, a 2-s delay was used.

Maintenance procedures were implemented following initial treatment for each target food. By the end of this condition, the preferred food and social praise were delivered after approximately 25% of all accepted bites. Follow-up data were not collected for Nancy, because she resided out of state and could not be scheduled for any observations after discharge.

Table 2
Mean Performance Across Conditions for Nancy

Condition	Number of sessions	Mean percentage of bites			Mean number of grams consumed
		Acceptance	Expulsion	Disruption	
Baseline	9	85.6	45.8	50.9	26.3
Treatment of starch	13	89.3	26.5	13.8	39.3
Treatment of vegetable	10	97.7	25.3	2.4	56.2
Maintenance	6	91.6	17.0	7.6	61.7

Results

Figure 2 shows the percentages of bites that Nancy accepted, and the percentages of accepted bites that she expelled, of starch, vegetable, meat, and other food items (data are not presented for liquid, which she accepted well, or for fruit, which was used as the reinforcer). Nancy accepted all foods on 75% or more of all trials during baseline. However, a large number of these bites were expelled. During treatment, when reinforcement was provided for food acceptance, decreases in food expulsion were observed. Some decrease was also noted in expulsion of other food groups (e.g., desserts), which remained in baseline. During the maintenance condition, acceptance of all foods remained high and expulsion was low.

Table 2 shows Nancy's condition means for acceptance, expulsion, disruptive behavior, and grams of food consumed. These data indicate an increase in the amount of food consumed, which corresponded with a decrease in Nancy's food expulsion. Also, as was the case with Joan, a marked reduction in Nancy's disruptive behavior was observed during the treatment conditions.

Nancy's weight on admission and at discharge was 24.75 lb. She lost 1.5 lb during baseline, which was regained during subsequent treatment conditions. Finally, although it was not possible to obtain controlled follow-up data, regular telephone contact was maintained with Nancy's parents for up to 2 years after her discharge. The parents reported that Nancy continued to do well at home and that her eating improved further over time: Chewing and self-feeding skills had developed after 1 and 2 years, respectively.

Case 3: Jerry

Jerry was a 40-month-old, nonambulatory male with a seizure disorder and left hemiplegia. His mother reported that he had been a poor eater since 1 year of age, and his preadmission diet consisted of many bottles of milk and small amounts of a few highly preferred foods. Initial evaluations indicated that his diet was deficient from a nutritional standpoint, although his weight was appropriate. The nutritionist recommended that he be given frequent access to bottles throughout the study.

Procedures

Five foods were offered at each 40-bite meal, one presented every 30 s. Meat, vegetable, and starch items (which varied daily according to the standard hospital menu) were selected as target foods, and yogurt was identified as a preferred food. As was the case with Joan and Nancy, Jerry's treatment was planned to follow a multiple-baseline design. However, due to apparent generalization observed during treatment for the first food group (meat), a reversal design was used to evaluate the effects of intervention.

Throughout the two treatment conditions for

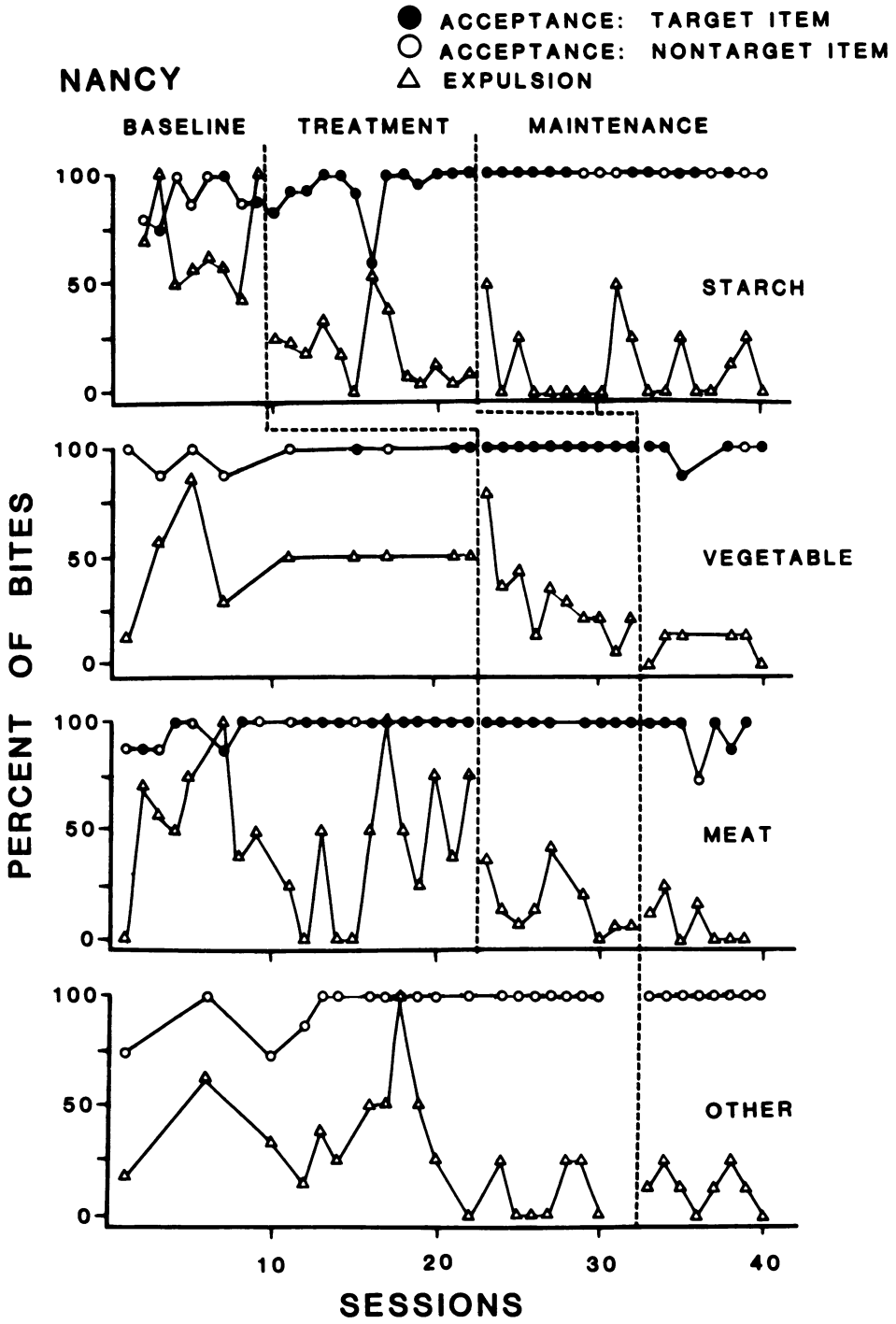

Figure 2. Percentages of bites that Nancy accepted and expelled of starch, vegetable, meat, and other foods. ●—acceptance of items presented during initial treatment sessions; ○—acceptance of items that were never exposed to the initial contingency; and △—food expulsion.

meat, a bite of the preferred food was delivered contingent on both acceptance and retention of the target food. Maintenance procedures were implemented later across all food items, and consisted of reinforcement for approximately 50% of correct bites. One month after Jerry's discharge from the hospital, data were collected at a follow-up meal, during which 25% of correct bites were reinforced.

Results

Figure 3 shows the percentages of bites that Jerry accepted and the percentages of accepted bites that he expelled of meat, vegetable, starch, and fruit (data are not presented for liquids, which Jerry consumed appropriately, or for other food groups that were presented infrequently). Throughout all conditions, Jerry accepted a high percentage of bites that were fed to him from all food groups. During baseline, however, he expelled most of the meat and vegetables, and starch to a lesser extent. When small amounts of yogurt were given to Jerry when he accepted and swallowed any meat item, his expulsion decreased to the point that no bites of meat were expelled during the last four meals of this condition. Concurrent with the reduction in expulsion of meat, expulsion also decreased for two untreated food groups—vegetable and starch. Withdrawal of treatment for meat resulted in increased expulsion of meat, vegetable, and starch, as well as fruit, which was rarely expelled during the initial baseline. Expulsion of all foods decreased again when treatment was applied to meat, and remained low during maintenance.

Table 3 shows Jerry's condition means for acceptance, expulsion, disruptive behavior, and food consumed. His data show a pattern of change similar to that of Nancy: Grams of food comsumed increased as expulsion decreased. His disruptive behaviors, although not as high initially as Joan's or Nancy's, also decreased during treatment.

Jerry gained 2 lb over the course of the study, from an admission weight of 27.5 lb to a discharge weight of 29.5 lb. Also, as his eating improved, his daily access to bottles was reduced from eight during baseline to three during the maintenance condition.

Table 3
Mean Performance Across Conditions for Jerry

Condition	Number of sessions	Mean percentage of bites			Mean number of grams consumed
		Acceptance	Expulsion	Disruption	
Baseline 1	5	90.5	34.8	10.6	97.6
Treatment of meat 1	15	98.6	22.6	8.4	109.5
Baseline 2	9	100.0	25.8	3.9	114.4
Treatment of meat 2	17	98.8	20.3	3.4	112.0
Maintenance	9	100.0	14.7	0	150.6
Follow-up	1	98.0	9.1	5.0	186.2

Follow-up data collected 1 month after Jerry's discharge were comparable to those obtained during the maintenance condition (see Figure 3). In addition, a social worker conducted a telephone interview with the mother 7 months following discharge, at which time the mother reported that Jerry did not exhibit any feeding problems, that he had developed self-feeding skills, and that he no longer drank from a bottle.

Case 4: Holly

Holly was a 26-month-old female diagnosed with failure to thrive and hydrocephalus. At 3 months of age, a gastrostomy tube had been surgically inserted into her stomach due to extremely low food intake and excessive vomiting. Since that time, Holly would consume small amounts of food intermittently, but oral intake was always erratic and never accounted for a significant proportion of her caloric or nutritional needs. Pediatricians and occupational therapists had been unable to identify any oral motor or swallowing difficulties to explain Holly's failure to eat. Her present admission was scheduled to evaluate the effectiveness of behavioral interventions to promote oral intake. Gastrostomy tube feedings were continued throughout the study.

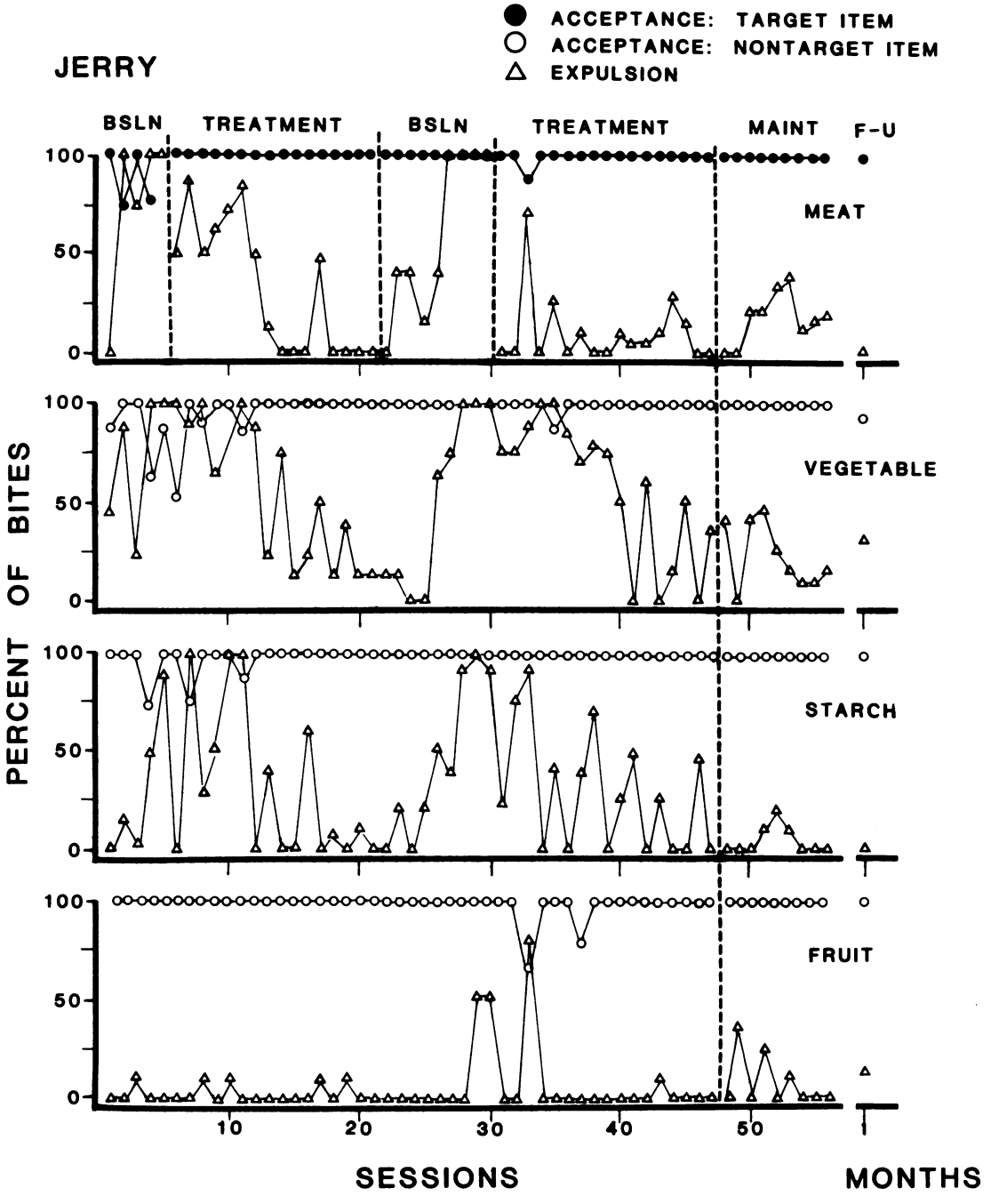

Figure 3. Percentages of bites that Jerry accepted and expelled of meat, vegetable, starch, and fruit. ●—acceptance of food items presented during initial treatment sessions: ○—acceptance of items that were never exposed to the initial contingency; and △—food expulsion.

Procedures

For each meal, alternating bites of two food groups were presented, one every 45 s, for a total of 20 bites per meal. During baseline, Holly rarely accepted a bite of any food item. Based on these low rates of acceptance and the nutritionist's recommendations, a meat item (scrapple, a meat product consisting of pork and cornmeal), a liquid (milk), a starch (mashed potato), and a fruit (banana) were selected as target foods. Social praise and access to toys were identified as potentially reinforcing stimuli.

Treatment was implemented in a multiple-baseline design across the four target food items, beginning with meat. Each accepted bite was followed by praise and the therapist's manipulation of a toy with Holly until the next interval. When Holly refused the food, the experimenter removed the toy from her sight and physically guided her to open her mouth so that the food could be deposited. Food expulsion and other disruptive behaviors were ignored.

Follow-up data were collected 2, 4, 5, and 12 months after Holly's discharge. Treatment procedures were in effect during the first three follow-up sessions, whereas the 12-month data were collected under baseline conditions. Additional details regarding Holly's follow-up are described later.

Results

Figure 4 shows the percentages of bites that Holly accepted and expelled of meat, liquid, starch, and fruit (data are not presented for vegetable or other items that appeared infrequently on her food tray). Holly ate almost nothing during baseline; what little food she did accept was immediately expelled. When treatment was implemented, her acceptance increased and remained high at follow-up. The effects of treatment on Holly's food expulsion were less dramatic. Expulsion remained at 100% during the first treatment meal for each food group. During subsequent meals, expulsion decreased for meat and starch, but continued to be rather high for liquid and fruit.

Table 4 shows Holly's condition means for acceptance, expulsion, disruptive behavior, and food consumed. Consistent with overall results for the other children, Holly's data show increases in food acceptance and grams of food consumed, and decreases in food expulsion and disruptive behavior over the course of treatment.

Table 4
Mean Performance Across Conditions for Holly

Condition	Number of sessions	Mean percentage of bites			Mean number of grams consumed
		Acceptance	Expulsion	Disruption	
Baseline	20	0.5	100.0	99.3	0.4
Treatment of meat	17	33.5	78.1	67.4	4.1
Treatment of meat & milk	15	74.7	57.1	27.7	8.1
Treatment of meat, milk, & starch	19	80.3	47.9	14.7	12.9
Treatment of meat, milk, starch, & fruit	11	90.9	49.5	8.6	11.0
Follow-up	4	78.0	49.9	17.5	29.3

On discharge, Holly's oral food intake was still quite low in that she expelled almost half of what she accepted. Holly's mother continued to use the treatment procedures at home and provided tube feedings as a supplement to ensure adequate daily intake. Initial follow-up observations (see Figure 4, at 2, 4, and 5 months) indicated that Holly's eating maintained after discharge, although no further improvements were seen. The 12-month follow-up, on the other hand, revealed that Holly's expulsion had decreased greatly. During that session, she consumed 79 g of food, which was more than on any previous occasion. At that time it was determined that Holly's caloric intake was adequate, but that her consumption of liquid was still quite low. She was readmitted to the hospital, where procedures similar to those used previously increased liquid intake from a baseline mean of 6 oz per day to a treatment mean of 17 oz per day.

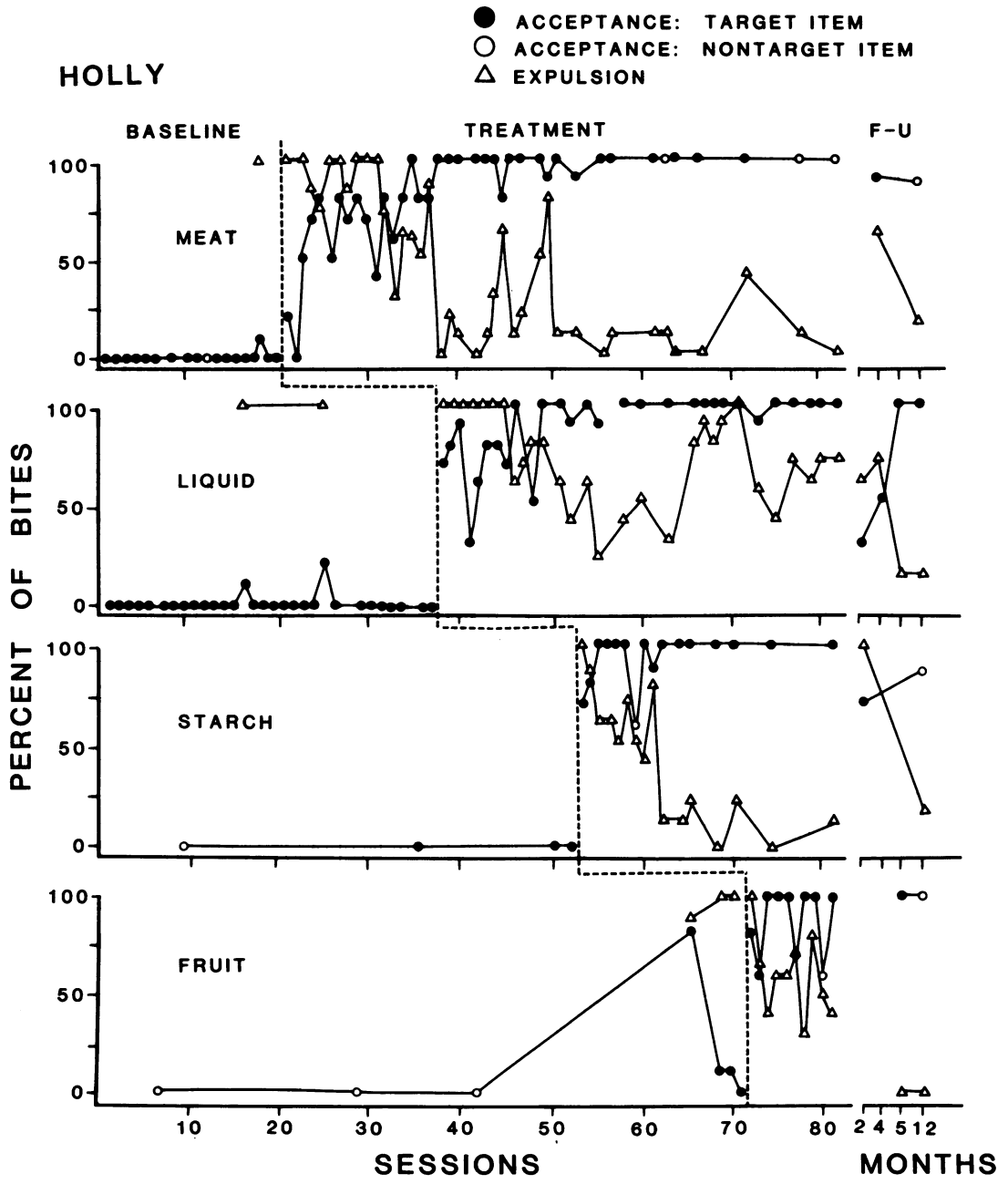

Figure 4. Percentages of bites that Holly accepted and expelled of meat, liquid, starch, and fruit. ●—acceptance of items presented during initial treatment sessions; ○—acceptance of items that were never exposed to the initial contingency; and △—food expulsion.

Holly's mother maintained and increased her daughter's oral intake of both solids and liquids during a 16-month period following this second discharge, at which time all gastrostomy feedings were terminated.

DISCUSSION

Present data indicate that food refusal may result from several related but different response topographies, and that each of these may be altered by way of shaping and contingency management. Each child in our study had a nutritionally inadequate diet requiring partial or total supplementation. Joan, Nancy, and Jerry exhibited both selective and low overall food intake, in that they either did not accept, or accepted and then expelled, a large proportion of most foods. Holly exhibited almost total food refusal. In addition, all children engaged in highly disruptive mealtime behavior consisting of crying, repeatedly turning away from food being presented, or pushing the spoon aside. Following the implementation of treatment, increases were noted in food acceptance and the amount of food consumed, while food expulsion and disruptive behavior decreased. Formal follow-up data for three of the children collected over a 1- to 12-month period suggested maintenance of treatment effects over time, and informal follow-up for all four children over 7 to 30 months revealed substantial further improvement in each case.

The assessment procedures used in this study represent a synthesis of techniques from a number of single-case reports, and provide a relatively standard method for measuring eating behavior and food intake in children who do not exhibit self-feeding skills. The procedures complement those described by Riordan et al. (1980) for self-feeding children and, together, allow for the quantification of multiple aspects of eating across a range of childhood feeding disorders (e.g., food refusal and selectivity, failure to thrive, excessive eating).

Several additional characteristics of the assessment require further elaboration. First, data taken on body weight showed little change during the course of treatment, in spite of substantial improvements in food intake. In light of this finding, one might question the severity of the children's eating problems at the outset of the study. It must be noted that each of the children was maintained at roughly appropriate body weight prior to admission by unlimited access to preferred but nutritionally deficient foods, delivery of dietary supplements, or complete artificial (gastrostomy) feeding. Because these practices were decreased or eliminated as the children's eating improved, changes in body weight were unlikely. Second, some of the measures included in the assessment may appear redundant at first glance. For example, grams of food consumed generally corresponded to the behavioral measures (i.e., acceptance or expulsion) and, in cases of severe weight loss due to food refusal, increases in body weight alone may be an adequate indicator of successful intervention. Yet, the elimination of complementary measures would not be advisable. Amount of food eaten and body weight are outcome measures that *indirectly* reflect changes in the actual target behavior, which may be one or more of several responses. For this reason, continued monitoring of eating-related activity would seem necessary to evaluate the behavioral effects of treatment. Third, although the children in this study were fed complete meals following a session, experimental data were collected only during the initial portion of the meal (20 or 40 presentations). On several occasions, data taken for an entire meal were compared to the experimental data, and discrepancies in the percentages were very small. Thus, the observational data accurately reflected the children's mealtime behavior. Data on the amount of food eaten, on the other hand, were not indicative of total food intake, in that they only showed the grams consumed during a 20- or 40-bite feeding episode.

In evaluating the effects of treatment, variations occurred in terms of the response(s) selected for direct intervention and the contingencies used. The positive changes observed across children in spite of these variations suggest some degree of generality to the approach described here. Still, several

differences were noted that may have important implications for treatment. For example, consequences that were made contingent only on food acceptance were also quite effective in reducing Joan's and Nancy's food expulsion, whereas the results for Holly were less consistent. The high degree of correspondence between acceptance and expulsion for Joan and Nancy may have been due to the type of reinforcement used and its temporal proximity to the target response. That is, delivery of a preferred food soon after accepting a target food may have reduced the likelihood that the target food would be expelled, and may have coincidentally reinforced swallowing (at least intermittently). On the other hand, Holly's extensive food refusal precluded the effective use of edible items as reinforcers. In her case, the target response (acceptance of food) and the reinforcer (social praise and access to toys) shared no topographical similarities.

Another difference concerned the extent to which the children began to eat food items that were never associated with the initial treatment procedure. For Joan, Nancy, and Holly, a specific food item within each food group was selected for initial treatment to increase the likelihood that the children would discriminate the particular food associated with reinforcement. In each case, little or no change was observed across baselines following intervention with the first food item. Generalization was noted for each of the three children only after treatment had progressed to other food items. By the end of the study, they readily accepted a number of foods that were not fed to them during initial treatment. The selection of target foods for Jerry, as well as his performance, differed markedly from the other children. When his treatment was initiated for meat, no specific type of meat was used during sessions; instead, he was fed whatever meat happened to appear on his food tray. It is possible that this procedural variation amounted to what Stokes and Baer (1977) have called "training sufficient exemplars" from the outset of treatment, and it may account for covariation in Jerry's data across meat, vegetable, and starch, when an ABAB manipulation was introduced for meat only. This is especially likely because there is no reason to believe that the children could correctly identify a specific food as belonging to a given food group. Thus, Jerry's data suggest that our separation of food items into different food groupings represented an arbitrary rather than a functional classification.

Finally, Holly's treatment also differed from the other children's in that it contained not only positive components, but an aversive one as well. The prompting technique resembled very closely an avoidance contingency in which Holly could prevent a forced response on each trial by accepting the initial presentation of food. It is impossible to determine whether or not Holly's eating in fact constituted an avoidance response, due to the combination of contingencies that was used.

In addition to addressing some of the issues we have raised, future researchers should attempt to evaluate other forms of treatment that may be effective, but for which little or no empirical data exist. One possibility would involve the use of more natural contingencies to promote food intake. Because children who chronically refuse food are often sustained through other means, appropriate food consumption may not represent a very strong operant response. If so, restricted availability of supplementation or artificial feeding may serve a motivating function in the absence of any additional intervention. In conducting studies of this type, and any others involving the regulation of food intake in at-risk populations, appropriate consultations should be obtained, and extreme caution should be exercised to ensure the continued well-being of the client.

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